The Backup Planning Scale (BUPS): A Brief, Self-Reported Measure of a Person's Tendency to Develop, Reserve, and Use Backup Plans

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The Backup Planning Scale (BUPS): A Brief, Self-Reported Measure of a Person's Tendency to Develop, Reserve, and Use Backup Plans

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ABSTRACT

To mitigate uncertainty in their goal pursuits, people use backup plans, i.e., alternative means that are developed to potentially replace "Plan A." Several studies have demonstrated that backup plans can introduce unexpected costs into goal pursuits that decrease a person's motivation to continue using their "Plan A," and reduce their chances for achieving their goal. These existing studies used time-intensive experimental and/or observational approaches to assess the effects of backup planning. The present research examines the newly-developed Backup Planning Scale (BUPS) for its measurement invariance, reliability, validity, and other psychometric characteristics across three independent samples with more than 1,500 participants. Consistent with prior theorizing, we found support for a nine-item, three factor structure for the BUPS, indexing latent factors for a person's tendency to develop, reserve, and replace with (or use) backup plans. Furthermore, a novel "IRTree" based statistical technique provided evidence for the validity of the measure, as participants' responses to the BUPS were associated with their actual developing, reserving, and replacing backup planning behaviors in a logic task. We conclude that the freely-available BUPS is a simple, brief, reliable, and valid self-reported instrument for assessing backup planning behaviors across adulthood.

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People use self-regulatory actions to achieve their goals (Lerner & Busch-Rossnagel, 1981). Considerable research suggests that one's ability to develop and select goals, use appropriate goal pursuit strategies, and adjust strategies when faced with losses is associated with both goal achievement and positive development more generally (Freund & Baltes, 2002; Napolitano & Freund, 2019). However refined a person's self-regulatory actions may be, the success of one's goal pursuits is rarely, if ever, guaranteed. To manage this uncertainty, people often develop *backup plans*, which have been defined as "alternative means to an end that a person develops, but not does not initially use" (Napolitano & Freund, 2016). For an example backup plan, consider a job application process. A job seeker is likely to apply for both a "first-choice" position, as well as one or more somehow less-desirable "backup" positions.

Does having a backup plan improve one's chances of success in goal achievement? It seems highly plausible, as the more means a person has available, the more committed they are to a goal (Kruglanski et al., 2011), and the more likely they are to achieve it (Huang & Zhang, 2013). To use the above example, an applicant applying to multiple positions is more likely to be hired somewhere. Although backup plans are prudent components of many goal pursuits, emerging evidence suggests that backup plans can introduce unexpected costs into goal pursuits, and these costs can reduce one's chances to achieve a goal (Nijenkamp et al., 2018; Sharif & Shu, 2017; Shin & Milkman, 2016; Straub & Schmid, 2018).

Given this building evidence, we believe that an important next step is to begin examining when, where, and for whom investments in backup plans may jeopardize goal pursuits. To date, investigations of backup planning have largely relied on observational or experimental research designs. These techniques are important for understanding variations in the psychological processes that may underlie adaptive or maladaptive backup planning, but they are also costly, time intensive, and may be difficult to implement remotely. A brief, free-to-use, reliable and valid self-reported measure of backup planning behaviors would allow multidisciplinary researchers to efficiently investigate variations in the use and usefulness of backup plans. At present, no such measure exists. Therefore, the purpose of this research is to assess the factor structure, reliability, and validity of a new self-reported measure of backup planning behaviors, termed the backup planning scale (hereafter BUPS). Before describing the scale development, we will briefly introduce key concepts for backup plan research.

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Developing, reserving, and replacing: Three phases of backup planning

It is first important to distinguish our use of the term backup plans from some colloquial uses. Backup plans are alternative *means* to achieve an *end*; they are not alternative ends, nor are they concurrently used equifinal means. For example, consider a housepainter. Their desired end is to quickly paint a house well. Their "first choice" means are to use an efficient paint sprayer. Their backup plan is to use a roller and brushes, a slower method.

It is also important to distinguish backup plans (the outcome of backup planning) from the process of backup planning. Backup plans are alternative ways of achieving an end. Backup planning comprises three phases: *developing, reserving, and replacing* (see Napolitano & Freund, 2016 for a detailed description). During the developing phase, a person invests resources into creating or refining their backup plan. In the case of the house painter, they purchase a roller, and research best methods for using this tool. The reserving phase occurs during the goal pursuit itself, and involves a person pursuing their goal by using their "first choice means" and keeping their backup plan in reserve. For example, imagine the house painter using the paint sprayer, having considerable issues, and starting to debate whether it is now time to switch to using the roller. Finally, the replacing phase occurs when a person elects to change their approach from their first-choice means to their backup plan. Here, imagine the house painter choosing to put the sprayer away and begin rolling paint on the walls.

Benefits and challenges for research using a three-phase model of backup planning

Organizing backup plan research along this three-phase model allows for more-refined investigations of when, where, why, and for whom backup planning an adaptive strategy. In contrast to research that might investigate whether simply "having" a backup plan impacts goal striving, backup planning research from the three-phase model investigates particular actions, and how variations in the use of those actions predict success in goal achievement. For example, across five observational or experimental studies, recent work demonstrated that the more a person invests in *developing* their backup plan, the more likely they are to *replace* Plan A, and the less likely they are to achieve their goal. This effect has been termed the *backup plan paradox* (Napolitano & Freund, 2017). To return to the example of the job applicant, the backup plan paradox would suggest that investing considerable time and effort into applying for less-desirable employment opportunities increases the likelihood of eventually accepting those positions.

The three-phase model of backup planning is not without its challenges, however. Backup planning actions that fall under the developing and replacing phases often have clear behavioral manifestations. For example, a person invests time or money into researching a backup plan, and then later they perhaps elect to use it and replace their Plan A. In comparison, it seems likely that behavioral manifestations of reserving a Plan B (e.g., thinking about available backup plans and internally debating whether they may prove more useful than one's current Plan A) may often be less clear, or at least more difficult to observe. Thus, a self-report measure can be more helpful to tap into these internal processes than observational methods.

The present research

To summarize, backup planning comprises several distinct self-regulatory actions that can be arrayed across three phases. No self-reported measure of backup planning currently exists. Therefore, the purpose of the present research was to assess the viability of one such measure, termed the backup planning scale (BUPS). We organized our research along five research questions tested across three studies.

Research question 1: Can responses to the BUPS be modeled as "developing," "reserving," and "replacing" factors across studies?

We expect that a three-factor (developing, reserving, replacing) solution for concurrently modeling responses to the BUPS will achieve at least strong measurement invariance across three studies. To examine an alternative modeling approach, we will also assess whether the BUPS items can be modeled using a single latent factor.

Research question 2: Can the three BUPS factors be invariantly measured across participant gender? Are there significant gender differences in backup planning?

To date, no study assessing developing, reserving, and replacing behaviors has demonstrated significant gender differences, nor have there been any hypothesized gender differences. We expect that the developing, reserving, and replacing factors can be invariantly measured across male and female participants, and we do not anticipate any significant gender differences with regards to latent means.

Research question 3: Is participant age significantly associated with developing and reserving backup plans?

Research from the lifespan developmental perspective has identified that younger adults focus on maximizing gains in their goal pursuits, whereas middle-aged adults focus on maintaining their resources and older adults focus on minimizing resource losses (Freund et al. 2018). These tendencies have been hypothesized to extend to backup planning behaviors (Napolitano & Freund, 2016). In general, older adults are hypothesized to selectively or prudentially invest in developing backup plans, and more-carefully manage the costs associated with reserving backup plans (e.g., not actively compare first-choice and backup plans during goal pursuits). Moreover, with regards to developing, older adults may leverage their life experiences to develop backup plans more efficiently than younger adults.

Taken together, these hypothesized relations between age and backup planning should result in increasing participant age being associated with lower levels of developing and reserving backup plans. We do not have specific age-related predictions regarding replacing with backup plans; this tendency may be more associated with other characteristics (see below).

Research question 4: Are responses to the BUPS characterized by discriminant, convergent, and divergent validity, and are they associated with actual backup planning behaviors?

Discriminant validity

We expect that factors for the tendency to develop, reserve, and replace a Plan A with a backup plan will be empirically distinct from two components of personality: conscientiousness and negative emotionality (sometimes referred to as neuroticism). Conscientiousness refers to one's tendency toward self-control, responsibility, dilligence, and order. Conscientiousness and self-regulated goal striving are clearly related. Moreover, some have contended (Hennecke et al., 2014) that normative life-span developmental changes in goal pursuits contribute to the normative pattern of increased conscientiousness with age (Roberts et al., 2006). We expect, however, that conscientiousness is empirically distinct from the tendency to develop, reserve, and replace a Plan A with backup plans. For example, it is plausible that a different, similarly-conscientious housepainter may have carefully read instructions for their paint sprayer, and only purchased that tool for their housepainting job.

We expect that negative emotionality, or persons' tendency to experience negative emotions, will also be empirically distinct from the three backup planning factors. People high in negative emotionality may be more likely to worry before unpredictable goal pursuits, or may react more negatively to setbacks (Robinson, 2007). However, other work suggests that, when faced with challenging goals or setbacks, people high in negative emotionality either tend to act impulsively or do not adjust their approach to goal striving at all (Ireland et al., 2015). Those contrasting responses likely result in a lack of systematic associations between negative emotionality and backup planning. For example, a housepainter with higher negative emotionality might plausibly be more likely to purchase the backup roller in an attempt to mitigate worries about the sprayer, or forge ahead with a single means and disengage from the goal entirely after setbacks.

Convergent and divergent validity

We used self-efficacy and optimism to assess convergent and divergent validity. Others have implied potential associations between backup planning and these two constructs (Shin & Milkman, 2016). Self-efficacy is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994). We expect that people reporting higher self-efficacy also report a lower tendency to invest in developing backup plans and a lower tendency to replace with (i.e., use) backup plans: if a person expects that they are capable of achieving their goals in a general sense, then they probably tend to spend less time and energy planning for contingencies. We assess the association between self-efficacy and reserving here in an exploratory sense. However, it seems reasonable that self-efficacy is negatively related to backup planning: if a person is believes that they are capable of achieving a goal, they should also be likely to forge ahead using their "Plan A," while not typically deliberating whether a backup plan might better suited for the goal.

We included optimism in the study to provide information regarding divergent validity. Optimism is defined as "extent to which people hold generalized favorable expectancies for their future" (Carver et al., 2010, p. 879). We expect that people who are generally optimistic also tend to develop, reserve, and replace less with their backup plans. In other words, we expect that people who are optimistic report engaging in less backup planning.

Predictive validity

In a final series of analyses, we investigate whether participants' responses to the BUPS predict actual backup planning behaviors using an online shape-naming task (described in detail in Napolitano & Freund, 2017). We anticipate that behavioral manifestations of developing and replacing with backup plans are straightforward to observe in this task: participants reporting higher levels of the developing factor will invest more time in developing a backup plan, and participants reporting higher levels of the replacing factor will use their backup plan more frequently. In prior work, we posited that keeping backup plans actively in reserve likely increases the chance of their actual use. Thus, we also anticipate that higher levels of the reserving factor would also predict more actual backup plan use.

We note that this research was exploratory and based on research questions. These were the first assessments of the BUPS, and we did not preregister any hypotheses.

Method

The present research involves three studies, all conducted online with samples of adults, and was conducted at the University of Zurich. The research complies with the ethics committeés requirements of the University of Zurich.[1] For each study, we report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. Study 1 was an initial test of the BUPS items' psychometric characteristics. Data presented in Study 2 were part of a larger, currently unpublished study on adults' goal pursuits and emotions. Study 3 was designed to explicitly

[1]These regulations define a two-stage process of ethical clearance. The first stage is a self-assessment of ethical risks by the researcher according to a checklist provided by the Ethics Committee. The present research passed the first stage, and was exempt from further review by the Ethics Committee.

test the validity of the BUPS. Because we organized our research around research questions that sometimes involved combing datasets across studies, we first present the characteristics of each study before then reporting the overall results. The data and analysis scripts used for this article can be accessed at https://osf.io/j2cfp.

Study 1

Participants

Study 1 represented an initial test of the BUPS. We anticipated that the items could be represented by three latent factors, and with our aim for a brief measure, that each factor would have three or four indicators. Our lower-bound estimation for the average loading of the indicators was between .50 and .60. We recruited a sample of participants ($N = 361$) using Amazon's MTurk service. Based on results from Wolf et al. (2013), this sample provides sufficient power. Research has suggested that participants recruited via MTurk provide data quality that is at least comparable to traditional methods (Buhrmester, Kwang, & Gosling, 2011). Of the participants, 46.5% identified as female and 80.9% identified as White, 6.6% as Black, 5.3% as Latino/a and 7.2% as Asian, Pacific Islander, Native American, Multiracial, or other. Participants' average age was 44.2 years ($SD = 17.1$), with participants' age ranging from 19.8 to 78.7 years. Participants in this and all studies reported living in the United States.

Procedure

After providing consent and sociodemographic information, participants completed an online questionnaire that included items pertaining to their goals and self-regulation, including the BUPS. We report only those items relevant to this research. The average competition time was about six minutes. Participants in all studies were compensated with a small financial award.

Measures

Backup planning scale (BUPS)

Participants completed 13 items to index their tendency to develop, reserve, and replace with backup plans.[2] Five items indexed participants' tendency to *develop* backup plans. An example item was "I often spend a lot of time and effort making backup plans before I get started on an important goal." For items indexed participants' tendency to *reserve* backup plans. An example item was "Even when already pursuing a goal, I keep a backup plan ready to go just in case I might need it." Four items indexed participants' tendency to *replace with* backup plans. An example item was "I often switch to Plan B when Plan A is not working well." All items were scored on a six-point Likert type format, with responses ranging from 0 (Not at all like me) to 5 (Very much like me). Full texts of the items are presented in Appendix 1. Appendix 2 provides item means, standard deviations and intercorrelations for each study.

[2]In total, participants completed 25 items pertaining to backup planning. We drafted 12 experimental items designed to index participants' *beliefs* about developing, reserving, and replacing with backup plans. These items were not the focus of this research, and were not analyzed.

Study 2

Participants

Participants ($N = 721$) were recruited via MTurk. These data were collected as part of a larger study, and aspects of that larger study dictated sample size. Nevertheless, this sample is sufficiently powered for the analyses we describe below (Wolf et al., 2013). Of the participants, 47.9% identified as female and 82.5% identified as White, 6.1% as Black, 3.9% as Latino/a and 7.5% as Asian, Pacific Islander, Native American, Multiracial, or other. Participants' average age was 44.4 years ($SD = 17.1$), with participants' age ranging from 20.1 to 78.7 years.

Procedure

After providing consent and sociodemographic information, participants completed an online study that involved providing responses about their emotions during hypothetical goal pursuits. After this portion of the study, participants completed the BUPS items. We report only on those items relevant to this research. The average competition time was about eight minutes.

Measures

BUPS

Participants completed the same 13 items used to index participants' tendency to develop, reserve, and replace with backup plans. All items were scored on a six-point Likert type format, with responses ranging from 0 (Not at all like me) to 5 (Very much like me).

Study 3

Participants

For Study 3, $N = 487$ participants were recruited by Prolific, a study recruitment firm that maintains a vetted research participant pool (www.prolific.co). A sample this size is sufficiently powered to detect weak-to-medium associations between BUPS factors and their behavioral referents (Wolf et al., 2013). Of the total 487 participants, 473 completed the BUPS items, and 429 completed the entire study. Participants who dropped out from the study after completing the BUPS, but before completing the study did not differ significantly in terms of their gender or ethnicity. We report the demographic characteristics of those participants who completed at least the BUPS here: 39.6% identified as female and 65.9% identified as White, 9.7% as Black, 9.7% as Latinx, and 14.8% as Asian, Pacific Islander, Native

American, Multiracial, or other. For privacy reasons, participants provided only their year of birth. The approximate average age was 33.6 years ($SD = 12.0$), with participants' approximate age ranging from 18 to 79 years.

Procedure

After providing informed consent and sociodemographic information, participants completed the BUPS items. Participants next completed an online shape naming task, which we describe in greater detail below. After this task, participants responded to several psychological scales, reported in the measures section. The average completion time was about 17 minutes.

Shape naming task

We adapted a task to assess whether participants' responses to the BUPS items corresponded to their backup planning behaviors. This task is described in detail elsewhere (Napolitano & Freund, 2017). Here, we describe it briefly. The task had four main phases: (1) the initial phase; (2) the backup planning development choice; (3) the developing phase; and (4) the trial phase.

Initial phase. We asked participants to identify the correct name for twenty shapes with patterns using simple logical rules we provided. During any trial, if they decided that they could not correctly name the shape, they could view "backup notes" that they could develop. The backup notes provided the information to find the name of any shape.

Correctly providing the name for the shape using only logic was described as participants' "Plan A," and earned them an additional $0.10 for each shape. Correctly providing the name for the shape after consulting their backup notes was described as participants' "Plan B," and earned them the lesser amount of an additional $0.07 for each shape. Incorrectly naming the shape resulted in no payout for that trial.

Backup plan development choice. After learning the basic parameters of the task, participants read the following prompt:

> Now it's up to you to decide how much time and effort you would like to invest in preparing your backup plan. Remember, Plan A is to answer the questions using logic only. Plan B is answering the questions for partial credit, using a guide.

Participants were then were shown a screen with two options for how to proceed. They could either choose to invest "a little" or invest "a lot" in developing backup notes. Based on this choice, participants completed one of two versions of the developing phase, described below.

Developing phase. For all participants, the developing phase involved unscrambling a 5 (shape) × 8 (pattern) grid of shapes to develop their backup notes. Participants who selected to highly invest in developing their backup plans had a fully scrambled grid, with no symbols in the correct location, and only written instructions for the correct vertical and horizontal order of the grid. In contrast, participants who chose to invest less in developing their backup plan had a simpler unscrambling task: patterned shapes in top row and the first three columns were locked in their correct locations. In both tracks, participants could not proceed until they had successfully unscrambled the grid. Participants in both tracks completed "backup notes" that were identical and thus were identically instrumental during the task.

Trial phase. The trial phase provides participants the opportunity to reserve and/or replace with backup plans. Participants began the trial phase by viewing three practice items, which, like the trial items, were arrayed as multiple-choice questions with five potential responses: three possible shape names, one "none of the above option" and one "check your backup notes" option. To the left of the response options, a small 3 (shape) × 4 (pattern) grid of shapes was consistently displayed. This grid provided sufficient information for participants to logically deduce a potentially correct response for every trial.

Next, 20 trials were displayed in a fixed order. Fourteen trials required participants to use deductive logic (in seven cases, the correct option was "none of the above"). In two trials, the symbol was displayed in the small grid, and the correct name was provided as a response option. In four trials, the symbol was displayed in the small grid, but the correct response was "none of the above." There were four trials for each of the five shapes, and all eight patterns were displayed in either two or three trials. After completing the 20 trials, participants were notified of their additional earned compensation and debriefed.

Measures

BUPS

Participants completed the same 13 items used to index participants' tendency to develop, reserve, and replace with backup plans. Due to a coding error, all items were scored on a seven-point Likert type format, with responses ranging from 0 (Not at all like me) to 6 (Very much like me). We also report item characteristics in the Results section.

Personality factors

Conscientiousness and negative emotionality were personality were assessed using 6 items from the Big Five Inventory 2 Extra Short Form (BFI2-XS; Soto & John, 2017). An example item for conscientiousness was "Is reliable, can always be counted on." An example item for negative emotionality was "Worries a lot." All items were scored on a seven-point format, with responses ranging from 1 (Disagree strongly) to 7 (Agree strongly). Reliability for these factors were low ($\omega_{\text{Conscientiousness}} = .55$; $\omega_{\text{Negative emotionality}} = .42$) but consistent with expectations (Soto & John, 2017).

Self-efficacy

Participants' general self-efficacy was assessed using the 10-item Generalized Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). An example item was "I can always manage to solve difficult problems if I try hard enough." All items were scored on a seven-point format, with responses ranging from 1 (Not at all true) to 7 (Exactly true). Reliability for this factor was good, $\omega = .88$.

Optimism

Participants' optimism was assessed using the relevant six items of the Life Orientation Test-Revised (Scheier et al., 1994). An example item was "In uncertain times, I usually expect the best." All items were scored on a seven-point format, with responses ranging from 1 (I disagree a lot) to 7 (I agree a lot). Reliability for this factor was good, $\omega = .85$.

Observed developing behavior

Participants' dichotomous choice to invest "a little" or "a lot" in developing their backup plans during the shape naming task served as an index of developing behavior. Of the 469 remaining participants, 383 (81.7%) chose to invest less in developing their backup plans, while 86 (18.3%) chose to invest more. To investigate the relationship between backup plan development and participant gender and age, we used two logistic regressions. The analysis showed that neither gender ($z = -0.24$, $p = .81$) nor age ($z = 0.63$, $p = .53$) was associated with this backup plan development choice.

Reserving and replacing behavior

We used the number of times participants elected to use their "backup notes" during the shape-naming task as an indicator of their reserving and replacing behaviors. For replacing, we predicted that participants who reported a greater tendency to replace with backup plans in their lives generally would also do so in this task. For reserving, we predicted that people would use backup plans more often because reserving backup plans makes them more psychologically "available" or salient.

Of the 429 participants who completed the task and BUPS items, 168 (39.2%) did not use the backup plan, and 96 (22.4%) used their backup plan once. Of a possible 20 uses, participants averaged using their backup plan about two times ($M = 2.28$, $SD = 3.36$). Poisson regressions in conducted in Mplus 8 demonstrated that the number of backup plan uses was associated with neither participant age ($\beta < .01$, $p = .61$) nor sex ($\beta < .01$, $p = .94$).

Preliminary analyses

For the first two studies, each item had six response categories, whereas for the third study, each item had seven response categories. Therefore, it was necessary to put scores on a common metric before testing invariance of the factor structure. To do this, we implemented a normalizing procedure. First, we computed the percentile ranks for each item separately for the three studies. Using the resultant values, the corresponding normal z-score values were found, resulting in normalized scores that are on a common metric.

Results

Research question 1: Can responses to the BUPS be modeled as "developing," "reserving," and "replacing" factors across studies?

To address our first research question, we conducted a series of analyses in three steps. First, using data from Study 1, we assessed whether the BUPS items could be modeled as three distinct latent constructs representing factors for the tendency to develop, reserve, and replace with backup plans. Second, again using data from Study 1, we tested whether an alternative approach to modeling the data—modeling a single "backup planning" factor—provided a significantly better fit to the data than the three-factor approach. Finally, we tested for measurement invariance of the final resulting model across all three datasets.

We addressed these aims using a confirmatory factor analysis approach. Model fit was gauged by several indices: Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and root mean square error of approximation (RMSEA). Indications of good fit were CFI and TLI close to .95 and RMSEA close to .06 (e.g., Hu & Bentler, 1999). To evaluate measurement invariance, we used an approach comparing models with sequentially more constraints using ΔMFI. In each comparison, if ΔMFI is less than .02, then the more constrained model is preferred (Cheung & Rensvold, 2002). Unless otherwise noted, all analyses were done using the R package lavaan using the MLR estimator, which is robust to data no-normality.

Modeling factors for the tendency to develop, reserve, and replace with backup plans

We first specified a concurrent three-factor model using all 13 BUPS indicators. This model did not fit well (CFI = .943; TLI= .928, RMSEA = .081; RMSEA 90% CI = [.072, .091]). Model misfit arose from four items that covaried and/or cross-loaded on other factors. We next specified a three-factor, nine-indicator model, selecting the three highest-loading indicators for each factor. This model fit well (CFI = .979; TLI= .968, RMSEA = .063; RMSEA 90% CI = [.047, .080]). Factors for the tendency to develop, reserve, and replace factors were reliable (ωs = .90, .92, and .89, respectively). Figure 1 displays this model.

Our next step was to test whether an alternative model for BUPS responses provided more accurate and/or more parsimonious representations of the data. Using the same nine indicators as the three-factor approach above, we tested whether a single, underlying latent backup planning factor provided a parsimonious way to model the data. This model fit poorly (CFI = .846; TLI= .795, RMSEA = .161; RMSEA 90% CI = [.148, .175]). Given this result, we proceeded with the three-factor, nine-indicator approach for modeling responses to the BUPS.

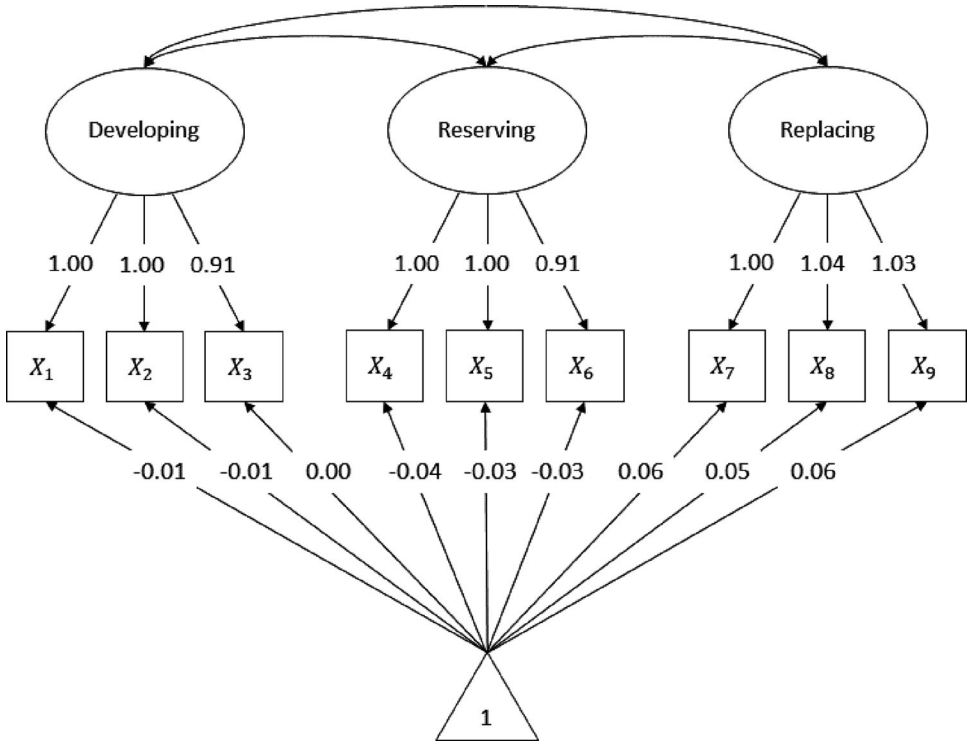

Figure 1. Backup plan self-report measures path model.

Measurement invariance across studies 1, 2, and 3

We then tested to see whether this three-factor model could be invariantly modeled across the three studies. A standard four level hierarchy of invariance was tested; that is, we sequentially fit configural, weak, strong, and strict invariance models to determine which model fit the data best. Using the previously discussed ΔMFI approach, it was found that the strict invariance model fit best for these data (ΔMFI = 0.00, CFI = 0.99, TLI = 0.99, RMSEA = 0.05, 90% CI [0.04, 0.05]). The full results for the invariance test between studies are shown in Table 1. Group latent means, variances, reliabilities, and correlations are given in Table 2.

Table 1. Invariance test results for backup planning scale factors across the three studies.

Model	*df*	CFI	TLI	RMSEA	RMSEA 90% CI	MFI	ΔMFI
Configural	72	0.98	0.98	0.06	[0.05, 0.07]	0.93	–
Weak	84	0.98	0.98	0.06	[0.05, 0.06]	0.93	0.00
Strong	96	0.98	0.98	0.05	[0.05, 0.06]	0.93	0.00
Strict	114	0.99	0.99	0.05	[0.04, 0.05]	0.93	0.00

Note. *df* = Degrees of freedom; CFI = Comparative fit index; TLI = Tucker-Lewis index; RMSEA = Root mean square error of approximation; MFI = Multi-fit index.

Table 2. Estimated latent means, variances, and correlations of BUPS factors, by study.

		Study 1			Study 2			Study 3		
		Dev	Res	Rep	Dev	Res	Rep	Dev	Res	Rep
Correlations	Dev	1.00	–	–	1.00	–	–	1.00	–	–
	Res	0.96	1.00	–	0.93	1.00	–	0.93	1.00	–
	Rep	0.67	0.66	1.00	0.71	0.69	1.00	0.52	0.52	1.00
Variances		0.67	0.68	0.60	0.67	0.70	0.61	0.64	0.67	0.56
Means		0.00	0.00	0.00	−0.01	0.02	−0.09	−0.04	−0.04	−0.11
Reliability (Ω)		.897	.919	.894	.901	.924	.900	.897	.922	.890

Note. Dev = Developing backup plans factor; Res = Reserving backup plans factor; Rep = replacing with backup plans factor. Reliability for Study 3 was calculated using non-transformed data. Latent means computed with Study 1 values as reference point.

Research question 2: Can the three BUPS factors be invariantly measured across participant gender? Are there significant gender differences in backup planning?

We next assessed whether the BUPS factors could be invariantly measured across men and women. The data were pooled across studies. As shown in Table 3, using ΔMFI as a gauge, we found evidence that the strict invariance model fit best for these data, according to standard fit indices (ΔMFI = 0.01, CFI = 0.98, TLI = .98, RMSEA = 0.06, 90% CI [0.05, 0.06]). There were no significant differences in latent means between men and women for any factor.

Research question 3: Is participant age significantly associated with developing, reserving, and/or replacing with backup plans?

In contrast to the gender analyses, there was a small, statistically significant relationship between age and two of the three backup planning factors. For every additional year of age, the tendency to develop a backup plan decreased by 0.004 SD units ($z = -2.42$, $p = .02$), and the tendency to reserve a backup plan decreased by 0.004 SD units ($z = -2.52$, $p = .01$). In other words, older adults reported investing less in developing backup plans and reported lower costs to reserve backup plans. There were no significant age-related differences in participants' reports of their tendency to replace Plan A with backup plans.

Table 3. Invariance test results for backup planning scale factors across men and women, pooled across studies.

Model	DF	CFI	TLI	RMSEA	RMSEA 90% CI	MFI	ΔMFI
Configural	48	0.98	0.98	0.06	[0.05, 0.07]	.93	–
Weak	54	0.98	0.98	0.06	[0.05, 0.07]	.93	.00
Strong	60	0.98	0.98	0.06	[0.05, 0.07]	.93	.00
Strict	69	0.98	0.98	0.06	[0.05, 0.06]	.92	.01

Note. *df* = Degrees of freedom; CFI = Comparative fit index; TLI = Tucker-Lewis index; RMSEA = Root mean square error of approximation; MFI = Multi-fit index.

In an exploratory step, we also assessed whether these age-related differences varied by participant gender. We ran two models for regressions predicting backup plan levels: one with regressions constrained to be equal between the genders, and one with regressions not constrained to be equal between the gender. A chi-square difference test between the models showed that there was a non-significant difference between them, $\chi^2(3) = 1.96$, $p = .58$. This means that the effect of age on the BUPS factors did not differ between genders.

Research question 4: Are responses to the BUPS characterized by convergent, divergent, and discriminant validity, and are they associated with actual backup planning behaviors?

Convergent and divergent validity

Consistent with expectations, we found that higher levels of the factor representing the tendency to replace Plan A with backup plans were associated with lower general self-efficacy ($\beta_{Rep} = -0.15$, $p = .047$). In contrast to expectations, general self-efficacy was not associated with the factor reflecting the tendency to developing backup plans. We did not have *a priori* expectations for the reserving factor, but we found that higher levels of the factor representing the tendency to reserve backup plans were associated with higher general self-efficacy ($\beta_{Res} = 0.48$, $p = .013$). All estimated regression coefficients and fit statistics for Research Question 4 are given in Table 4.

We also investigated the divergent validity of the backup planning factors using a measure of optimism. We expected that more optimistic people report a lower tendency to develop, reserve, and replace with backup plans. In contrast with our expectations, optimism did not provide support for divergent validity of the backup planning factors. None of the regression coefficients was significant at the $\alpha = .05$ significance level.

Discriminant validity

We then investigated the discriminant validity of the developing, reserving, and replacing tendency factors in predicting participants' self-reported levels of conscientiousness and negative emotionality. Consistent with our expectations, none of the regression coefficients was significant at the $\alpha = .05$ significance level.

Predictive validity of the developing measure

In a final series of tests, we assessed whether responses to the BUPS predicted actual backup planning behaviors using the shape naming task in Study 3. We first report results for the developing measure. To review, we predicted that participants reporting a higher tendency to invest in developing backup plans also invest more time in developing their backup plans. We tested this using a latent logistic regression approach. A model was fit with all three latent factors included and the investment in backup planning measure regressed onto the developing factor. This resulting model fit well (CFI = .97, TLI = .96, RMSEA = .04, 95% CI [.02, .06]). We found evidence for our anticipated effect: the odds of choosing to invest "a lot" of time increased by 33% for every SD increase in the self-reported developing factor ($z = 4.12$, $p < .001$).

Table 4. Estimated regressions and fit for predicting Big Five factors, general self-efficacy, and optimism.

	$\hat{\beta}_{Dev}$	*p*	$\hat{\beta}_{Res}$	*p*	$\hat{\beta}_{Rep}$	*p*	CFI	TLI	RMSEA
Conscientiousness	0.04	.83	−0.18	.32	0.09	.25	0.98	0.98	0.05
Neuroticism	0.08	.68	−0.06	.78	0.10	.21	0.98	0.98	0.05
Self-efficacy	−0.28	.15	0.48*	.01	−0.15*	.05	0.98	0.97	0.05
Optimism	−0.09	.61	0.10	.54	−0.01	.94	0.99	0.98	0.04

Note. * = $p < .05$; Dev = Developing backup plans factor; Res = Reserving backup plans factor; Rep = replacing with backup plans factor. Degrees of freedom; CFI = Comparative fit index; TLI = Tucker-Lewis index; RMSEA = Root mean square error of approximation.

Predictive validity of the reserving and replacing measures

We tested whether participants' tendency to reserve and replace with backup plans predicted the number of times they actually chose to use their backup plans in a task. To test this prediction, we used two bootstrapped latent Poisson regressions in Mplus 8. Consistent with expectations, we found that a greater tendency to reserve backup plans predicted the number of times participants chose to use backup plans ($\beta = 1.31$, $p < .001$, 95% CI [0.17, 1.48]). In contrast, a greater tendency to replace Plan A with backup plans was not significantly associated with the number of times participants chose to use backup plans ($\beta = .20$, $p = .75$).

An IRTree approach to assessing the validity of each backup planning measure

We used a novel second approach to further investigate the unexpected lack of association between participants' tendency to replace Plan A with backup plans and their actual replacing of backup plans in the shapes naming task. To review, 90% of the shape naming trials required deductive logic to respond correctly (i.e., the information presented on screen was incomplete to answer the item). However, there was variation in the difficulty of each item: items required between one and three deductive steps to correctly answer. In addition, for each item, participants could choose to see the complete set of information by using their backup plan. Choosing to replace with the backup plan therefore changes the difficulty of the item.

Thus, the outcomes were hypothesized to follow a decision tree process wherein a participant first decides whether to use the backup plan, then either answers the item correctly or incorrectly. We posited that the decisions at the

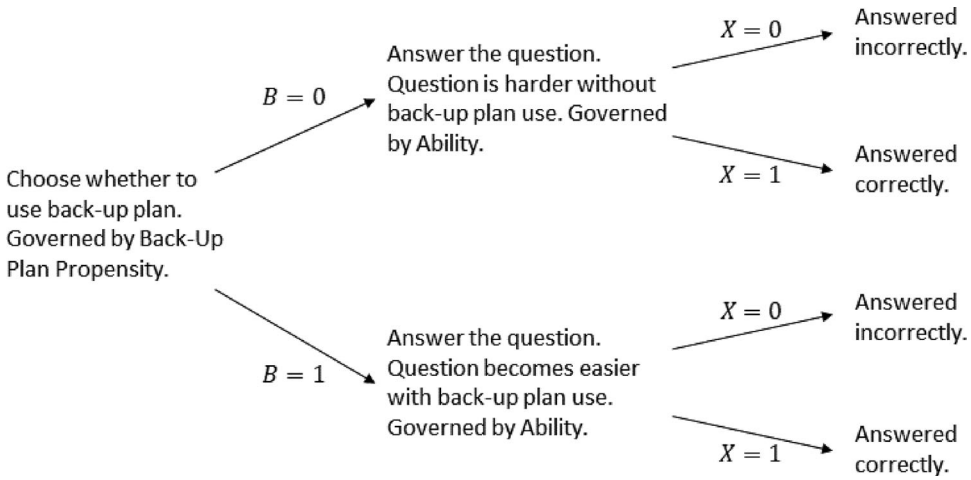

Figure 2. Backup planning task tree diagram.

first and second levels of the decision tree are governed by different individual characteristics—the first-level decision (i.e., to use a backup plan or not) is controlled by a participants' propensity to reserve and replace Plan A with a backup plan, whereas the second-level decision (i.e., correct or incorrect response) is controlled by a participants' ability at the logical deduction task. This decision process is shown in Figure 2.

Analytically, this approach is consistent with IRTree models (Jeon & De Boeck, 2016). We used regressions to predict the latent traits associated with each decision level (i.e., using backup plans and ability). For comprehensiveness, we also included the latent factors for developing, reserving, and replacing as predictors. Participant age was included as a covariate. The full diagram of the analysis is shown in Figure 3.

Details on model programming, implementation, and interpretation. This is not currently a model supported by standard SEM software, and it represents a novel synthesis of several techniques. Thus, we review the programming and analytical technique here for the benefit of readers wishing to adopt a similar approach. We fit the model using Bayesian methodology and a software implementation of the Hamiltonian Markov chain Monte Carlo (H-MCMC) method called Stan through R, which allows for relatively fast and efficient convergence. To determine the final model used for interpretation, six progressively more constrained models were fit. The most complex model is shown in Figure 3, with the other five models obtained by progressively adding more constraints as described in Table 5. Overall, each model converged, with all R-hat statistics (Gelman & Rubin, 1992) less than 1.01.

The current state-of-the-art method for model evaluation uses leave-one-out cross-validation (LOO) with Pareto-smoothed importance sampling to estimate pointwise out-of-sample prediction accuracy of a fitted Bayesian model (Vehtari et al., 2017). Another widely used estimate of prediction accuracy is WAIC. For both statistics, the model with the smallest value is determined to be the best in terms of the compromise between overall fit and model complexity. A related value from the Bayesian literature is the Bayesian model averaging (BMA) weight. This weight can be interpreted as the probability that a model (out of a set of models) would be chosen as the best model (Fragoso et al., 2018). Two common BMA weights are pseudo-BMA weights and stacking weights; the stacking weights are considered to be more robust than the pseudo-BMA weights (Yao et al., 2018). As shown in Table 5, all four reported model evaluation statistics point to our full model shown in Figure 2 to be the best.

IRTree approach results. For each regression coefficient, their means and standard deviations, their marginal posterior probabilities, and their 80% and 90% credible intervals for the final model are shown in Table 6. Using $p_{\text{dir}} = .95$ as the cutoff for a significant effect,[3] we find that the reserving factor has a significant positive relationship with backup plan use ($p_{\text{dir}} = .95$), with every SD change in the self-reported reserving factor associated with an average 0.32 SD increase in backup plan use (Mean = 0.32, 90% CI [−0.03, 0.66]).

We also find that the replacing factor ($p_{\text{dir}} = .96$) and age ($p_{\text{dir}} = .99$) has significant negative relationship with the task ability level, with every SD change in the replacing factor and age associated with an average 0.12 SD (Mean = −0.12, 90% CI [−0.24, −0.01]) and 0.26 SD (Mean = −0.26, 90% CI [−0.35, −0.17]) decrease in the task ability level, respectively. It is notable that while these effects are relatively small in size, they are each consistent in their respective directions (i.e., the effects are clearly negative), particularly the effect of age on task ability level.

Summary of predictive validity results. Results suggest that our measures of the tendency to develop, reserve, and replace Plan A with backup plans validly index their

[3]The marginal posterior probability p_{dir} is the probability that for a given sample a given coefficient is in the direction of the mean effect. The value ranges between $p_{\text{dir}} = .50$ and $p_{\text{dir}} = 1.00$ with higher values indicating the robustness of the direction of the effect.

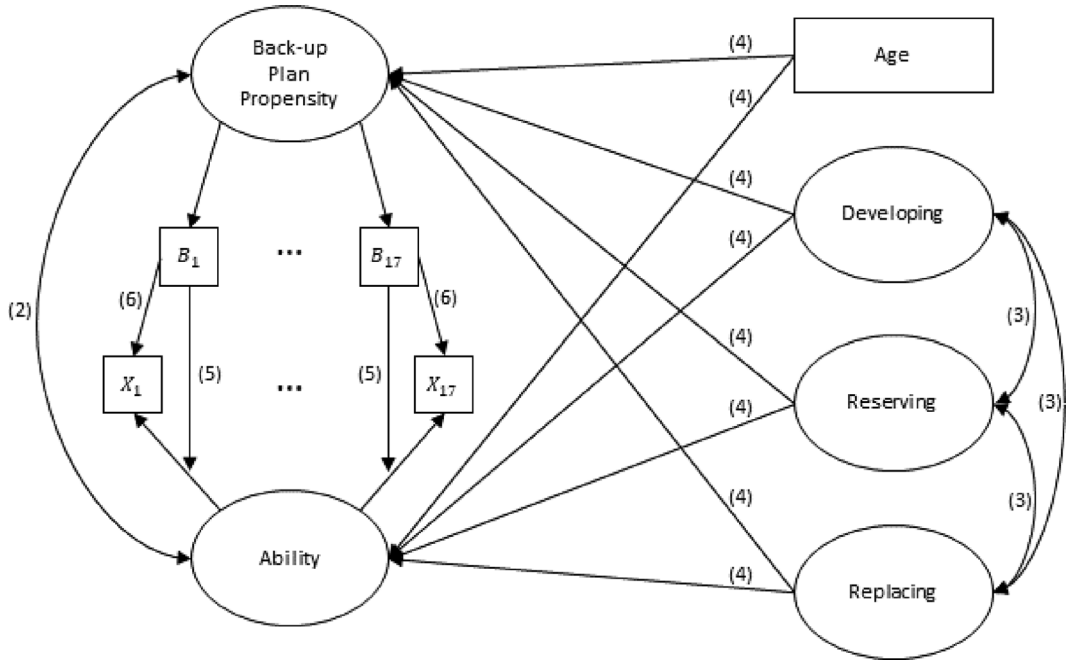

Figure 3. Backup planning task validation model path diagram. The number listed in parentheses corresponds to the model constraints described in Table 5.

Table 5. Results for a sequential series of IRTree models describing the behavioral task.

Model	WAIC	LOO	Pseudo-BMA	Stacking weights
(1) Full model shown in Figure 3.	13,470.4	13,706.4	99.79	74.10
(2) Correlations between behavior task measures are 0.	13,473.6	13,718.7	0.21	0.22
(3) Correlations between select-report measures are 0.	13,543.2	13,728.2	0.00	0.00
(4) Slopes of self-report measures on behavior task measures are 0.	13,546.7	13,913.5	0.00	0.00
(5) Effect of backup plan use on slopes is 0.	13,556.8	13,902.0	0.00	10.90
(6) Effect of backup plan use on intercepts is 0.	13,653.5	14,005.0	0.00	14.76

Models obtained by taking the previous model and adding the described constraint.
Note. WAIC = widely available information criteria; LOO = leave-one-out cross validation; BMA = Bayesian model averaging.

Table 6. Estimated regressions and marginal posterior probabilities for predicting backup plan use and task ability in Figure 2.

				80% Credible interval		90% Credible interval	
Backup plan use	Mean	SD	Posterior probability	Lower	Upper	Lower	Upper
$\hat{\beta}_0$	−1.33	0.12	1.00	−1.48	−1.17	−1.53	−1.13
$\hat{\beta}_{Dev}$	−0.25	0.22	0.88	−0.52	0.02	−0.61	0.09
$\hat{\beta}_{Res}$	0.32	0.21	0.95	0.06	0.60	−0.03	0.66
$\hat{\beta}_{Rep}$	−0.04	0.07	0.72	−0.14	0.05	−0.17	0.07
$\hat{\beta}_{Age}$	−0.05	0.06	0.80	−0.13	0.03	−0.15	0.05
				80% Credible interval		90% Credible interval	
Task ability	Mean	SD	Posterior probability	Lower	Upper	Lower	Upper
$\hat{\beta}_0$	−0.17	0.11	0.95	−0.30	−0.04	−0.35	−0.00
$\hat{\beta}_{Dev}$	−0.02	0.19	0.54	−0.27	0.21	−0.34	0.28
$\hat{\beta}_{Res}$	0.11	0.18	0.73	−0.12	0.35	−0.19	0.42
$\hat{\beta}_{Rep}$	−0.12	0.07	0.96	−0.21	−0.04	−0.24	−0.01
$\hat{\beta}_{Age}$	−0.26	0.05	1.00	−0.33	−0.19	−0.35	−0.17

Note. Marginal posterior probabilities are computed in the direction of the effect. Dev = Developing backup plans factor; Res = Reserving backup plans factor; Rep = replacing with backup plans factor. The 80% and 90% highest posterior density credible intervals for each parameter represent the smallest region within which an unobserved parameter falls with a given probability. Smaller regions represent more certainty with respect to the parameter value, with those not containing the zero value being likely to be truly significant.

respective backup planning actions. However, the results are complex. We found that that when participants reported a greater tendency to develop backup plans, they were more likely to invest more time into developing backup plans during the shape-naming task. In addition, as anticipated, we found that when participants reported a greater tendency to reserve backup plans, they used backup plans more often during the task. In contrast, participants' reports of their tendency to replace Plan A with backup plans did not predict their actual use of backup plans during the task. Instead, higher levels of self-reported replacing were associated with participants' "ability" in the task (as was participants' age; older adults performed less well than younger adults on this task).

Discussion

Developing, reserving, and replacing Plan A with backup plans are everyday actions that people use to manage uncertainty in their goal pursuits. Prior to this research, work investigating the use and usefulness of backup plans involved behavioral tasks in experimental or observational settings, methods well-suited to some, but not all research questions or settings. To be able to better understand the nomological network of backup planning, as well as the development of adaptive backup planning across the life span, we developed a brief self-report scale that indexes developing, reserving, and replacing Plan A with backup plans (the BUPS).

Using data from three independent samples, we found consistent evidence that the BUPS is well-suited for this task. Addressing Research Question 1, we found that the 9 items indexing participants' tendency to develop, reserve, and replace Plan A with backup plans could be modeled by three distinct and well-fitting factors. Each factor was characterized by a high degree of reliability and could be invariantly measured across the three independent samples.

Addressing Research Question 2, we found, as expected, that men and women did not differ significantly in their tendency to develop, reserve, and replace with backup plans. We note, however, that the BUPS focuses on a person's general backup planning tendencies. It may be that future research focused on specific types of goal pursuits that (at present) remain highly informed by gendered roles or expectations (e.g., goals involving the balance of work and family) would illustrate that men and women may differ in their backup planning.

Age-related differences in backup planning

A core principle of the life-span developmental psychology perspective is that successful aging involves the intentional use of actions to selectively invest one's declining resources toward the achievement of important goals. Therefore, in prior research, we hypothesized age-related differences in backup planning, such that older adults more selectively invest their limited resources in developing and reserving backup plans when compared to better-resourced younger adults (Napolitano & Freund, 2016). Results from Research Question 3 supported this theorizing: older participants reported a lower tendency to develop and reserve backup plans.

Before moving forward, we introduce two key points regarding age-related differences for backup planning here. First, these results do not imply that older adults are any less likely to "have" backup plans when compared to younger adults, or that, for real-world goal pursuits, older adults' backup plans are any more or less effective than those of younger adults. These are questions worthy of future inquiry. Our design of Study 3 intentionally afforded all participants backup plans of equal quality. Instead, our results imply that older adults, through what we propose as a combination of their life experience and self-regulatory tendencies toward less resource-intense goal pursuits, are less likely to expend their resources on developing backup plans and keeping them in reserve for later use. Our results are cross-sectional, and we cannot make any developmental interpretations regarding age-related differences in backup planning.

An initial exploration into the nomological network of backup planning

Given the impact that successful or unsuccessful backup planning may have on one's life course, one of the inspirations of this project was to provide future research with a tool to explore the psychological correlates, antecedents, and consequences of backup planning. This work was a first effort toward understanding the nomological network of backup planning. Some, but not all, of the results were consistent with our expectations. We found that none of the backup planning factors was associated with personality traits for conscientiousness or negative emotionality, suggesting a degree of discriminant validity. We also found that the tendency to replace Plan A with backup plans was associated with significantly lower self-efficacy. Other results were not expected: participants' self-efficacy was not associated with a lower tendency to develop backup plans, but self-efficacy was positively associated with participants' tendency to reserve backup plans, an association for which we did not have an *a priori* expectations. Furthermore, participants' levels of optimism were not associated with any of the backup planning factors; we expected optimistic people to backup plan less.

There is still work to be done to identify the psychological correlates of backup planning. In this research, we elected to measure a narrow band of prominent constructs to assess the BUPS' convergent and discriminant validity, in part due to practical concerns. Future work may benefit from a more inclusive approach that involves comparing responses on the BUPS to a broad battery of psychological scales. In addition, it may be fruitful to further explore the unexpected association between higher levels of self-esteem and a greater tendency to reserve backup plans. One way to interpret this result is that people with high-self esteem might expect that they are capable accurately identifying the ideal means for their goals. This active comparison (independent of investment or eventual use of a backup plan) encapsulates the reserving process. Those who are indeed able to efficiently reserve backup plans may reap the benefits of backup plans without extending the costs of their less-effective peers.

Disentangling reserving backup plans and replacing with backup plans

In the final set of analyses, we tested whether each factor measured by the BUPS predicted its referent behavior in a shape-naming task. As expected, we found that a greater tendency to develop backup plans was associated with participants' choice to invest more in developing their backup plans for the task. We expected that a greater tendency to reserve backup plans is associated with participants using

their backup plans more during a behavioral task, based on the assumption that highly available backup plans are more likely to be used. This expectation was also supported. Finally, we expected that a greater tendency to replace with backup plans is associated with participants using their backup plans more during the task. This expectation was not supported, and to investigate that unexpected result, we conducted a series of novel IRT-based analyses to further disentangle the reserving and replacing processes.

We found that participants' tendency to reserve backup plans predicted their likelihood to use backup plans, consistent with the simpler observed-level result. However, while participants' tendency to replace Plan A with backup plans did not predict their use of them, it did predict their ability at the task. Together, we interpret the results to mean two things. First, as we had hypothesized in prior work, it seems that participants who tend to keep backup plans actively in reserve tend to use them. In some cases, this use may benefit their goal performance, but in others, this use may harm their it (Napolitano & Freund, 2016). Second, consistent with the association between a higher tendency to replace Plan A with backup plans and lower self-esteem, it seems that participants' tendency to replace Plan A with backup plans overlaps to some degree with either their general ability to successfully pursue goals or, more narrowly, their ability to specify suitable Plans A for their goals. Said differently, it may be that people who report tending to replace Plan A with their backup plan may simply need to do so more often.

The centrality of the reserving process

We summarize these results from the predictive validity analyses by positing that how a person manages the reserving process may be of critical importance in determining whether they adaptively or maladaptively use backup plans. This interpretation is consistent with our earlier theorizing on backup plans (Napolitano & Freund, 2016). In describing variations in the usefulness of backup plans, we speculated that people intuitively make calculations of their goal pursuits' *complexity value*, or the difference between one's goal pursuit with a backup plan and their pursuit of that same goal without a backup plan, and use those calculations to decide whether to develop a backup plan, how to keep it in reserve, and when to replace Plan A with it. We further speculated that when investing in backup plans, people can overlook the practical and motivational costs of keeping them in reserve. Keeping backup plans available for potential later use could make them attractive options, undermining commitment to one's Plan A.

The results from the predictive validity analyses provide some support for these ideas, but more work is needed to examine the "black box" of the reserving process. For example, an eye-tracking study where one's backup plan is located on one part of the screen and their Plan A on another could provide an indication of how much person is considering using their backup plan.

Limitations

This research had two main limitations. First, we did not have a behavioral measure for the reserving process, relying on the number of backup plan uses as an index for both the reserving and replacing process. While this ultimately led to unique insights, future work would benefit from a direct measure of reserving at the behavioral level. A second limitation regards the scope of the BUPS, which was designed to assess a person's general tendencies to develop, reserve, and replace with backup plans. Although there is great benefit to a general scale, it may be that backup planning varies depending on different types of goals (e.g., social, athletic), or for goals on varying importance. However, the scale could be easily adapted to capture domain-specific backup planning by instructing participants to think of the goal domain of interest (e.g., "Now, we want you to think about how you usually go about how you go about pursuing your goals in the domain of [academic achievement/sports/the relationship with your friends, ….].

Summary

The purpose of this research was to design and test the psychometric characteristics of a brief measure of backup planning that corresponds to the three-phase model introduced in prior research. Across three samples, we find that the BUPS is a psychometrically sound measure that predicts a person's backup planning behaviors. The results of this research support theorizing on age-related variation in backup planning, and on the importance of the reserving process for adaptive backup planning. We encourage others to use this measure in their research and enhance our understanding of the antecedents, consequences, and correlates of backup planning.

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References

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (pp. 71–81). Academic Press. https://doi.org/10.4135/9781412952576.n182

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, *6*(1), 3–5. https://doi.org/10.1177/1745691610393980

Carver, C. S., Scheier, M. F., & Segerstrom, S. C. (2010). Optimism. *Clinical Psychology Review*, *30*(7), 879–889. https://doi.org/10.1016/j.cpr.2010.01.006

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation*

Modeling: A Multidisciplinary Journal, *9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Fragoso, T. M., Bertoli, W., & Louzada, F. (2018). Bayesian model averaging: A systematic review and conceptual classification. *International Statistical Review*, *86*(1), 1–28. https://doi.org/10.1111/insr.12243

Freund, A. M., & Baltes, P. B. (2002). Life-management strategies of selection, optimization, and compensation: Measurement by self-report and construct validity. *Journal of Personality and Social Psychology*, *82*(4), 642–662. https://doi.org/10.1037/0022-3514.82.4.642

Freund, A. M., Napolitano, C. M., & Rutt, J. L. (2018). Personality development in adulthood: A goal perspective. In D. P. McAdams, R. L. Shiner, & J. L. Tackett (Eds.), *Handbook of personality development* (pp. 313–327). Guilford Press.

Gelman, A., & Rubin, D. B. (1992). Inference from iterative simulation using multiple sequences. *Statistical Science*, *7*(4), 457–472. https://doi.org/10.1214/ss/1177011136

Hennecke, M., Bleidorn, W., Denissen, J. J. A., & Wood, D. (2014). A three-part framework for self-regulated personality development across adulthood. *European Journal of Personality*, *28*(3), 289–299. https://doi.org/10.1002/per.1945

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55.

Huang, S. C., & Zhang, Y. (2013). All roads lead to Rome: The impact of multiple attainment means on motivation. *Journal of Personality and Social Psychology*, *104*(2), 236–248. https://doi.org/10.1037/a0031039

Ireland, M. E., Hepler, J., Li, H., & Albarracín, D. (2015). Neuroticism and attitudes toward action in 19 countries. *Journal of Personality*, *83*(3), 243–250. https://doi.org/10.1111/jopy.12099

Jeon, M., & De Boeck, P. (2016). A generalized item response tree model for psychological assessments. *Behavior Research Methods*, *48*(3), 1070–1085. https://doi.org/10.3758/s13428-015-0631-y

Kruglanski, A. W., Pierro, A., & Sheveland, A. (2011). How many roads lead to Rome? Equifinality set-size and commitment to goals and means. *European Journal of Social Psychology*, *41*(3), 344–352. https://doi.org/10.1002/ejsp.780

Lerner, R. M., & Busch-Rossnagel, N. A. (1981). *Individuals as producers of their development*. Academic Press. https://doi.org/10.1016/c2013-0-11075-6

Napolitano, C. M., & Freund, A. M. (2016). On the use and usefulness of backup plans. *Perspectives on Psychological Science*, *11*(1), 56–73. https://doi.org/10.1177/1745691615596991

Napolitano, C. M., & Freund, A. M. (2017). First evidence for the backup plan paradox. *Journal of Experimental Psychology: General*, *146*(8), 1189–1203. https://doi.org/10.1037/xge0000331

Napolitano, C. M., & Freund, A. M. (2019). Adding life to one's added years: Self-regulatory balancing of life domains across old age. Commentary on "The life course cube: A tool for studying lives". In L. Bernardi, J. Huinink, & R. Settersten (Eds.), *Advances in life course research* (p. 41). https://doi.org/10.1016/j.alcr.2019.04.008

Nijenkamp, R., Nieuwenstein, M. R., de Jong, R., & Lorist, M. M. (2018). Controlling the resit effect by means of investment depreciation. *Journal of Cognition*, *1*(1), 37. https://doi.org/10.5334/joc.40

Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin*, *132*(1), 1–25. https://doi.org/10.1037/0033-2909.132.1.1

Robinson, M. D. (2007). Personality, affective processing, and self-regulation: Toward process-based views of extraversion, neuroticism, and agreeableness. *Social and Personality Psychology Compass*, *1*(1), 223–235. https://doi.org/10.1111/j.1751-9004.2007.00019.x

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, *67*(6), 1063–1078. https://doi.org/10.1037/0022-3514.67.6.1063

Schwarzer, R., & Jerusalem, M. (1995). Generalized self-efficacy scale. In J. Weinman, S. Wright, & M. Johnston (Eds.), *Measures in health psychology: A user's portfolio causal and control beliefs* (pp. 35–37). NFER-NELSON.

Sharif, M. A., & Shu, S. B. (2017). The benefits of emergency reserves: Greater preference and persistence for goals that have slack with a cost. *Journal of Marketing Research*, *54*(3), 495–509. https://doi.org/10.1509/jmr.15.0231

Shin, J., & Milkman, K. L. (2016). How backup plans can harm goal pursuit: The unexpected downside of being prepared for failure. *Organizational Behavior and Human Decision Processes*, *135*, 1–9. https://doi.org/10.2139/ssrn.2538889 https://doi.org/10.1016/j.obhdp.2016.04.003

Soto, C. J., & John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*(1), 117–143. https://doi.org/10.1037/pspp0000096

Straub, L., & Schmid, P. C. (2018 *It's not good for everyone to have a backup plan: People with relatively lower trait power get more distracted by backup plans and pursue goals less successfully*. 19th Annual Meeting of the Society of Personality and Social Psychology (SPSP 2018), p. A-027.

Vehtari, A., Gelman, A., & Gabry, J. (2017). Practical Bayesian model evaluation using leave- one-out cross-validation and WAIC. *Statistics and Computing*, *27*(5), 1413–1432. https://doi.org/10.1007/s11222-016-9696-4

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement*, *73*(6), 913–934. https://doi.org/10.1177/0013164413495237

Yao, Y., Vehtari, A., Simpson, D., & Gelman, A. (2018). Using stacking to average Bayesian predictive distributions (with discussion). *Bayesian Analysis*, *13*(3), 917–1007. https://doi.org/10.1214/17-BA1091